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## Designing climate resilient schools: a case study of St Faith's School, Cambridge

### Conference or Workshop Item

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UCL, London, 5-6 November 2012

1<sup>st</sup> International Conference on Urban Sustainability and Resilience

## The project

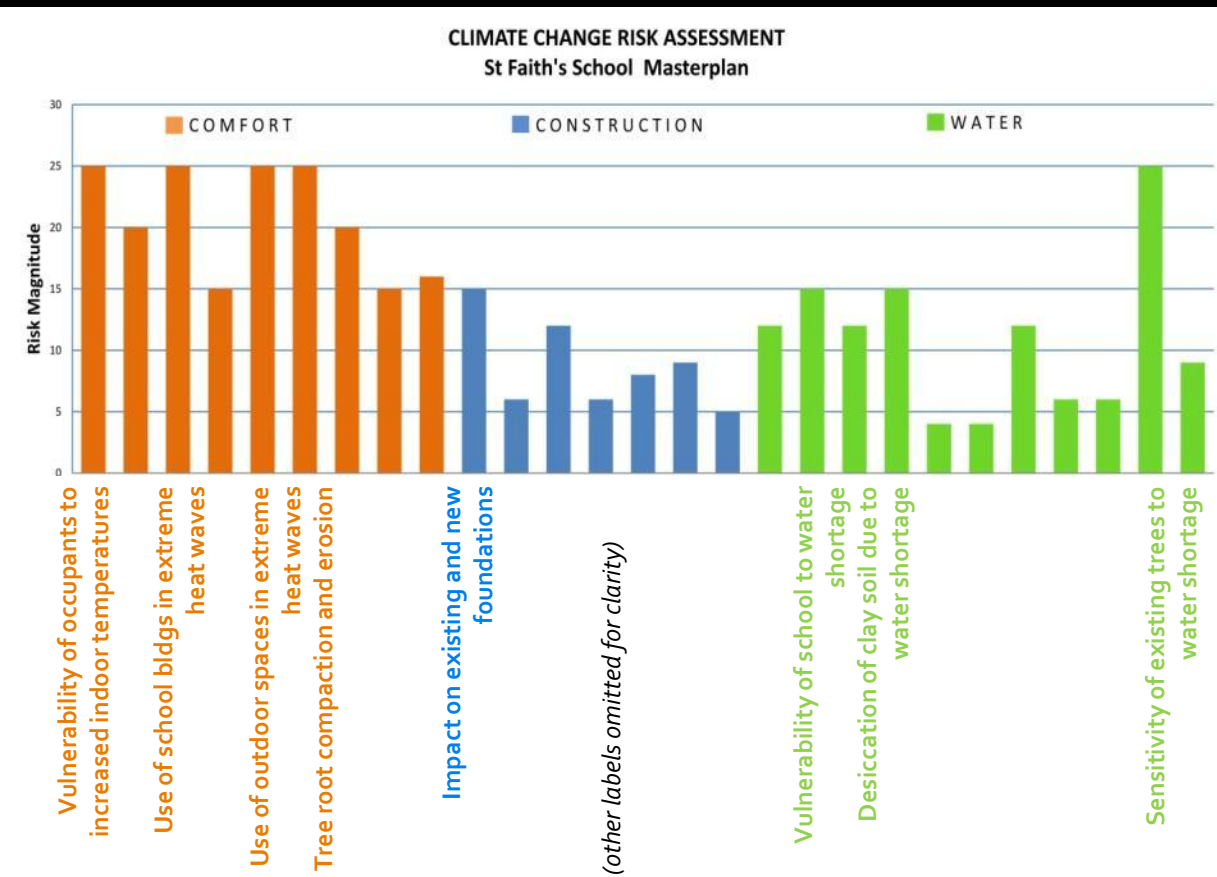
The research and practice project focuses on three separate buildings: a large Victorian house built in 1885, a smaller 1970s block with a recent extension, and a new single storey eco classroom using green materials.

The adaptation designs aim to ensure each of the three very different buildings remains fit for purpose throughout the 21st century, continuing to provide a healthy environment for the children.



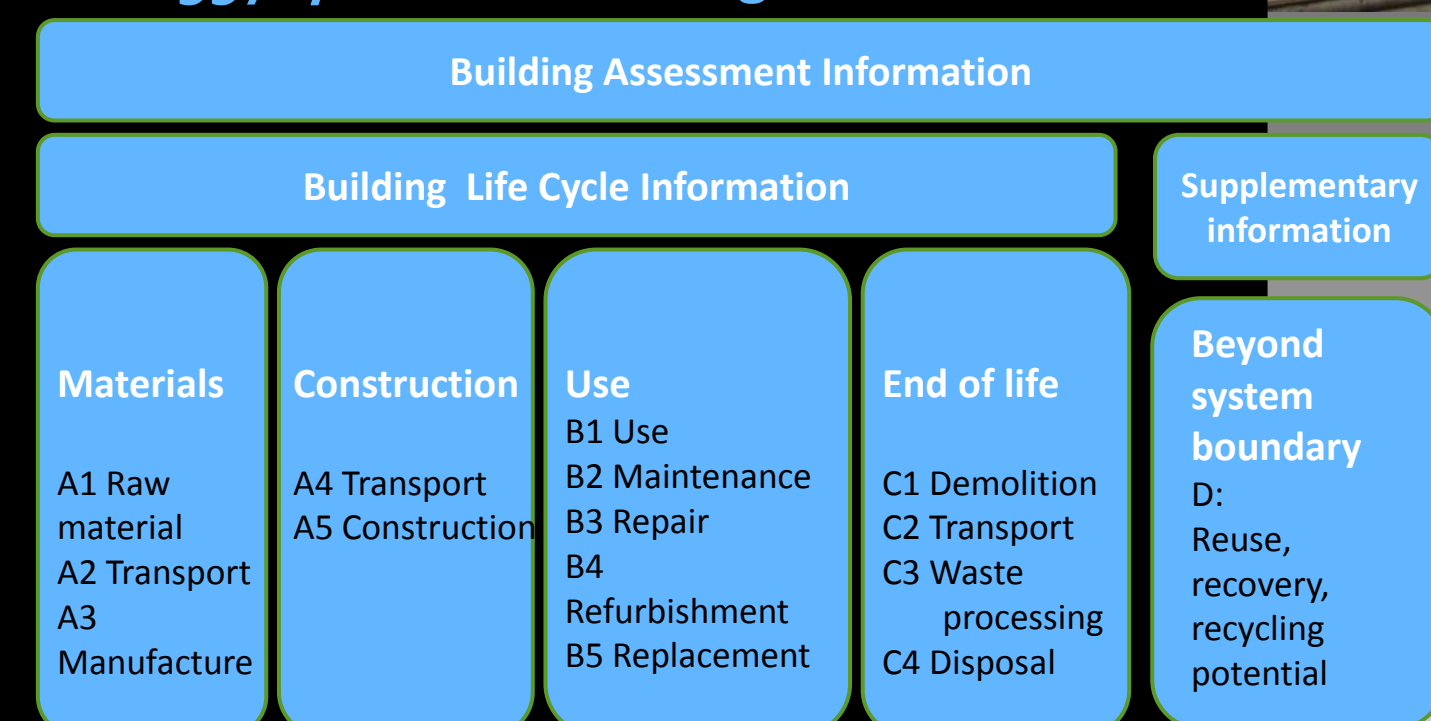
The implications of climate change have been considered for the three issues of comfort, construction, and water, as set out in the report on *Design for Future Climate: opportunities for adaptation in the built environment* (Gething, 2010).

Assessing risk against these issues as a whole team exercise identified 'Comfort' as the main focus for the study. The highest risk in 'Construction' is the impact on existing and new foundations. The sensitivity of existing trees to seasonal water shortages has been identified as a further risk, as their survival is important to maintain the benefits provided by shade and transpiration to the indoor and outdoor environment.



The reduction of whole life carbon and other negative environmental impacts are equally important aims for the school and project team.

Detailed thermal modelling of the design options is being carried out in TAS, by M&E consultants Roger Parker Associates, and PHPP, by Verve Architects. The Centre for Sustainable Development has developed a Climate Data Convertor for use with the PHPP (see central paragraph). The CfSD is also calculating the embodied carbon for the whole life cycle in accordance with BS EN15978, shown in the figure below:



## Introduction: Design for Future Climates

'Design for future climate: adapting buildings' is part of the Technology Strategy Board (TSB) funded 'Low impact buildings innovation platform'. St Faith's School and Verve Architects have been awarded £100k to develop an adaptation strategy for existing and new buildings that will:

- \* significantly reduce the overall energy consumption;
- \* enable the building to cope with future climates;
- \* extend the usable life of the building;
- and \* provide an exemplar case study for retrofit of other schools.

## Designing climate resilient schools: a case study



### St Faith's School, Cambridge

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## Mitigation and Adaptation for Climate Change in Schools

Social and political concerns are frequently reflected in the design of school buildings, often leading to the development of technical innovations. One example is a recurrent concern about the physical health of the nation, which has at several points over the last century prompted new design approaches to natural light and ventilation.

The most critical concern of the current era is the global, rather than the indoor, environment. The political focus on mitigating climate change has resulted in new regulations, and in turn considerable technical changes in building design and construction. The vanguard of this movement has again been in school buildings, set the highest targets for reducing operational carbon by the previous Government. Current austerity measures have moved the focus to the refurbishment and retrofit of existing buildings, in order to bring them up to the exacting new standards.

There is now little doubt that climate change is happening already, and that the impacts will be considerable. Climate scientists have increasing confidence in their predictions for the future; if today's buildings are to be resilient to these changes, building designers will need to understand and design for the predicted climates in order to continue to provide comfortable and healthy spaces through the lifetimes of the buildings.

This project addresses the challenges of both mitigation and adaptation, for an existing school. It is hoped that lessons from the design process, as well as the solutions themselves, will be transferable to other buildings in similar climates.

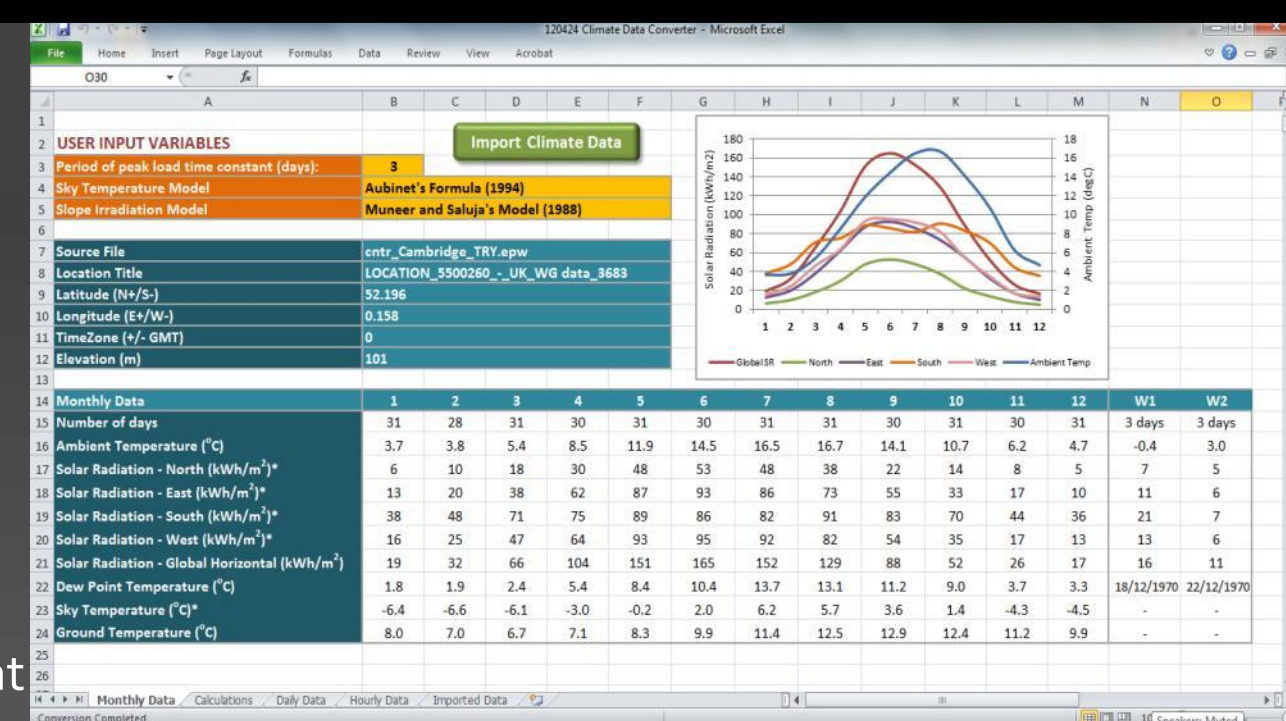


Before

The energy efficient retrofit measures to the 1970s extension were completed by the start of the research project. The TAS model demonstrates that the overheating thresholds set in BB101 will not be exceeded until 2080 for the 90th Percentile (HIGH emissions scenario). The PHPP models however have a lower threshold, and predict overheating from 2030 onwards increasing to 32% in 2080. Future retrofit measures are being developed.



After



Vicky Cheng at the Centre for Sustainable Development (CfSD) developed a Climate Data Convertor in order to use Exeter University Prometheus data with the Passive House Planning Package (PHPP). However the higher infrared radiation intensity given by Prometheus leads to a substantial increase in the sky temperature compared with other models. Therefore the Convertor adopts Aubinet's (1994) three-variable model for sky temperature calculation. The outputs of the Convertor show good agreement with weather data collected from BRE, Meteonorm and EnergyPlus.

Green roofs are being considered as one potential adaptation measure, particularly for retrofitting on to existing flat roofs. However, their full benefits cannot be simulated in PHPP or TAS. Although PHPP uses the thermal conductivity value of the soil and drainage mat layers in the U-value calculation, this does not describe the energy transfer through evaporation, reflection, convection and thermal mass.



Prefabricated timber panels being lowered into place for the new eco classroom. Locally sourced and filled with recycled cellulose insulation, these have a lower carbon footprint than conventional systems. They are also quicker to erect, and are highly airtight, contributing towards the aims for passivhaus standard.

This poster is presented by Alice Moncaster. Having gained practical experience as a design engineer for many years, Alice is now a Senior Research Associate at Cambridge University where she conducts interdisciplinary research into sustainable building, including embodied carbon, innovative materials, retrofit, and the development of a sociology of construction.

